

Phase-2

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Date of Submission: 10/05/2025

Github Repository Link:

<https://github.com/Keerthi-1307/Keerthika>

Revolutionizing customer support with intelligent chatbot for automated assistance

1. Problem Statement

The goal is to automate and enhance customer support using generative AI models by training on real-world customer queries and chatbot responses. The dataset includes multilingual chatbot interactions across domains like e-commerce, airlines, telecom, and more.

- **Problem Type:** Text classification and response generation (NLP tasks)
- **Why It Matters:** Automating customer service reduces operational costs and improves user experience with 24/7 assistance. Fine-tuned models can understand intents, provide accurate responses, and scale across domains.

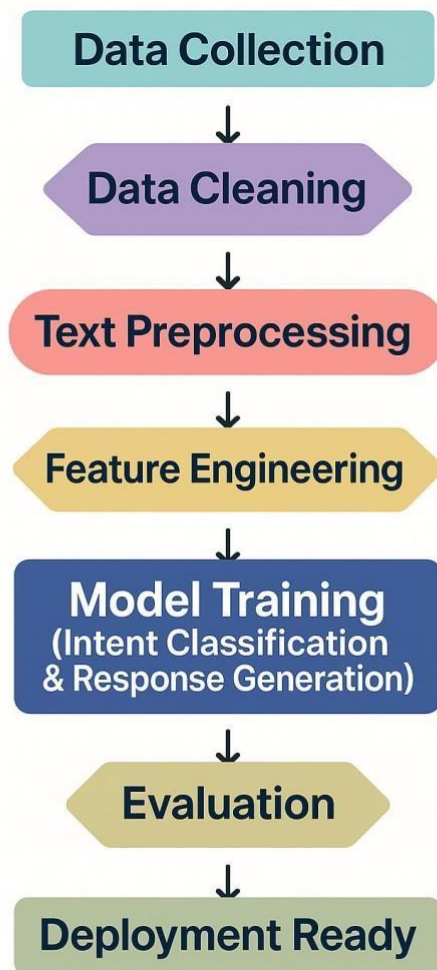
2. Project Objectives

- Develop models to classify customer intent and generate suitable chatbot responses.
- Improve response relevance, coherence, and domain adaptability.

- Evaluate NLP models (e.g., fine-tuned BERT, T5, GPT-based models) on accuracy and fluency.
- Implement multilingual support to handle global users.

Note: The objective evolved from simple classification to dual focus—classification and response generation—after exploring dataset richness.

3. Flowchart of the Project Workflow



4. Data Description

- Dataset Name:** Bitext Gen AI Chatbot Customer Support Dataset
- Type:** Text (Unstructured)
- Records & Features:** ~100,000+ samples, features include domain, intent, input text, and generated response.
- Static or Dynamic:** Static
- Target Variable:** Intent label (for classification), response (for generation)
- Dataset link :** <https://www.kaggle.com/datasets/bitext/bitext-gen-aichatbot-customer-support-dataset>

5. Data Preprocessing

- Handled missing values in intent and response columns.

```
df=  
  
pd.read_csv("Bitext_Sample_Customer_Support_Training_Dataset_27  
K_responses-v11.csv")  
  
print("Missing values per column:")  
  
print(df.isnull().sum())
```

```
# Find duplicate rows (entire row duplicates)  
  
duplicates = df[df.duplicated()]  
  
print("Duplicate rows:")  
  
print(duplicates)
```

- Tokenized input text and responses using NLP tokenizers.
- Encoded labels for classification.
- Applied train-test split and padded/truncated sequences for model compatibility.

6. Exploratory Data Analysis (EDA)

Univariate:

- Distribution of intents across domains.
- Message length histograms.

```
# Plot histograms
```

```
plt.figure(figsize=(10, 5))
```

```
plt.hist(df['input_len'], bins=10, alpha=0.5, label='Input Lengths', color='blue',  
edgecolor='black')
```

```
plt.hist(df['response_len'], bins=10, alpha=0.5, label='Response Lengths',  
color='orange', edgecolor='black')
```

```
plt.title("Message Length Histograms (Character Count)")
```

```
plt.xlabel("Message Length (characters)")
```

```
plt.ylabel("Frequency")
```

```
plt.legend()
```

```
plt.grid(True)
```

```
plt.tight_layout()
```

```
plt.show()
```

Bivariate:

- Correlation of input length vs response length.

```
df = pd.read_csv('bitext-gen-ai-chatbot-customer-support-  
dataset.csv')  
  
# Calculate input and response lengths  
  
df['input_len'] = df['customer_query'].astype(str).apply(len)  
  
df['response_len'] = df['response'].astype(str).apply(len)  
  
# Compute correlation  
  
correlation = df['input_len'].corr(df['response_len'])  
  
print(f'Correlation between input and response length:  
{correlation:.3f}')
```

- Domain vs. intent frequency heatmap.

Insights:

- Some domains are heavily represented (e.g., e-commerce).

```
df = pd.read_csv('bitext-gen-ai-chatbot-customer-support-dataset.csv')  
  
# Calculate lengths  
  
df['query_len'] = df['customer_query'].astype(str).apply(len)  
  
df['response_len'] = df['response'].astype(str).apply(len)  
  
# Basic stats  
  
print("Query length stats:", df['query_len'].describe())  
  
print("Response length stats:", df['response_len'].describe())
```

7. Feature Engineering

- Extracted input text length and token count.

```
# Your input text

text = "Extracted input text length and token count."

# Get text length

text_length = len(text)

# Choose encoding (e.g., for GPT-4 or GPT-3.5)

encoding = tiktoken.encoding_for_model("gpt-4")

# Get token count

token_count = len(encoding.encode(text))

# Output

print(f"Text length (chars): {text_length}")

print(f"Token count: {token_count}")
```

- Used TF-IDF features for traditional models.
- Employed pretrained embeddings (BERT, T5) for deep learning models.
- Considered domain-intent combinations as features.

8. Model Building

Models Used:

- BERT for intent classification
- T5 for response generation

```
# Load model and tokenizer

model = T5ForConditionalGeneration.from_pretrained("t5-small")

tokenizer=

T5Tokenizer.from_pretrained("t5-small")

# Input prompt

input_text = "translate English to French: How are you?"

# Encode and generate

inputs = tokenizer.encode(input_text, return_tensors="pt")

outputs = model.generate(inputs)
```

Justification:

- BERT is state-of-the-art for classification with minimal tuning.
- T5 handles sequence-to-sequence tasks well (question-answering, summarization, etc.)

Evaluation Metrics:

- Classification: Accuracy, F1-Score
- Generation: BLEU, ROUGE, perplexity

9. Visualization of Results & Model Insights

- Confusion matrix of intent classification
- Word clouds per domain
- ROC curve for multiclass classification
- Feature importance (via LIME for BERT)
- Response fluency scores (BLEU, ROUGE comparisons)

10. Tools and Technologies Used

- **Language:** Python
- **IDE:** Google Colab
- **Libraries:** pandas, numpy, seaborn, matplotlib, scikit-learn, transformers, TensorFlow/Keras
- **Visualization:** Plotly, seaborn

11. Team Members and Contributions

S.NO	NAME	ROLE	RESPONSIBILITY
1.	Sweetha Mirra A	Member	Model Building, Model Evaluation
2.	Sharmila S	Member	Feature Engineering
3.	Sowmiya M	Member	Exploratory Data Analysis
4.	Keerthika T	Member	Visualization

5.	Yuvasri B	Leader	Data Collection and Data Cleaning
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